CLAIM AMENDMENTS

1. (Cancelled)

2. (Cancelled)

3. (Cancelled)

4. (Cancelled)

5. (Cancelled)

6. (Cancelled)

7. (Cancelled)

8. (Cancelled)

9. (Cancelled)

10. (Currently Amended) A method for filling a mold by a desired fill profile having at least four filling stages, stage 1, stage 2, stage 3 and stage 4, associated with four time intervals, t_0 to t_1, t_1 to t_2, t_2 to t_3, and t_3 to t_4, respectfully, and with four pressure change intervals, P_0 to P_1, P_1 to P_2, P_2 to P_3 and P_3 to P_4, respectively, to make a cast article comprising the steps of:

(a) providing a molten metal to a casting chamber in fluid communication with the mold, the casting chamber having a supply conduit for introducing a gas into the casting chamber, and the casting chamber having an evacuation conduit for delivering the molten metal from the casting chamber to the mold;

(b) controlling the filling of the mold during the first time interval t_0 to t_1 of stage 1 by delivering the molten metal from the casting chamber to the mold at a first rate by supplying the gas to the casting chamber during stage 1 at t_0 at P_0 and at t_1 at P_1 to allow the molten metal to rise at the first rate, stage 1 including an acceleration portion wherein the molten metal is accelerated up to a desired fill rate for stage 1, the first rate operative to produce a first stage actual fill profile;

(c) controlling the filling of the mold during the second time interval t_1 to t_2 of stage 2 by delivering the molten metal from the casting chamber to the mold at a second rate by supplying the gas to the casting chamber during stage 2 at t_1 at P_1 and at t_2 at P_2 to allow the molten metal to rise at the second rate, the second rate operative to produce a second stage actual fill profile, the second rate being less than the first rate to thereby prevent the actual fill profile during the transition from the end of the first stage actual fill profile to the beginning of the second stage actual fill profile from overshooting the desired fill profile and causing the molten metal to bounce and create turbulence in the mold whereby the mold fills more slowly with molten metal during stage 2 than during stage 1 to thereby produce a smooth transition in the filling of the mold cavity indicated graphically by a gradually decreasing slope value during the transition from the end of stage 1 to the beginning of stage 2;

(d) controlling the filling of the mold during the third time interval t_2 to t_3 of stage 3 by delivering the molten metal from the casting chamber to the mold at a third rate by supplying the gas to the casting chamber during stage 3 at t_2 at P_2 and at t_3 at P_3 to allow the molten metal to rise at the third rate, the third rate being greater than the

second rate whereby the mold fills more quickly with molten metal during stage 3 than during stage 2, the third rate operative to produce a third stage actual fill profile; and

(e) controlling the filling of the mold during the fourth time interval t_3 to t_4 of stage 4 by delivering the molten metal from the casting chamber to the mold at a fourth rate by supplying the gas to the casting chamber during stage 4 at t_3 at P_3 and at t_4 at P_4 to allow the molten metal to rise at the fourth rate, the fourth rate operative to produce a fourth stage actual fill profile, the fourth rate being less than the third rate to thereby prevent the actual fill profile during the transition from the end of the third stage actual fill profile to the beginning of the fourth stage actual fill profile from overshooting the desired fill profile and causing the molten metal to bounce and create turbulence in the mold whereby the mold fills more slowly with molten metal during stage 4 than during stage 3 to thereby produce a smooth transition in the filling of the mold cavity indicated graphically by a gradually decreasing slope value during the transition from the end of stage 3 to the beginning of ~~stage 4,~~ stage 4.

11. (Previously Presented) The method of Claim 10 further comprising the step of providing a controller for controlling filling of the mold during the at least four filling stages.

12. (Currently Amended) A method for filling a mold by a desired fill profile having at least four filling stages, stage 1, stage 2, stage 3 and stage 4, associated with four time intervals, t_0 to t_1, t_1 to t_2, t_2 to t_3, and t_3 to t_4, respectfully, and with four pressure change intervals, P_0 to P_1, P_1 to P_2, P_2 to P_3 and P_3 to P_4, respectively, to make a cast article comprising the steps of:

(a) providing a molten metal to a casting chamber in fluid communication with the mold, the casting chamber having a supply conduit for introducing a gas into the casting chamber, and the casting chamber having an evacuation conduit for delivering the molten metal from the casting chamber to the mold;

(b) providing a transducer and a controller;

(c) controlling the filling of the mold during the first time interval t_0 to t_1 of stage 1 by delivering the molten metal from the casting chamber to the mold at a first rate by supplying the gas to the casting chamber during stage 1 at t_0 at P_0 and at t_1 at P_1 to allow the molten metal to rise at the first rate, stage 1 including an acceleration portion wherein the molten metal is accelerated up to a desired fill rate for stage 1, the first rate operative to produce a first stage actual fill profile;

(d) controlling the filling of the mold during the second time interval t_1 to t_2 of stage 2 by delivering the molten metal from the casting chamber to the mold at a second rate by supplying the gas to the casting chamber during stage 2 at t_1 at P_1 and at t_2 at P_2 to allow the molten metal to rise at the second rate, the second rate operative to produce a second stage actual fill profile, the second rate being less than the first rate to thereby prevent the actual fill profile at the transition from the end of the first stage actual fill profile to the beginning of the second stage actual fill profile from overshooting the desired fill profile and causing the molten metal to bounce and create turbulence in the mold whereby the mold fills more slowly with molten metal during stage 2 than during stage 1 to thereby produce a smooth transition in the filling of the mold cavity indicated graphically by a gradually decreasing slope value during the transition from the end of stage 1 to the beginning of stage 2;

(e) controlling the filling of the mold during the third time interval t_2 to t_3 of stage 3 by delivering the molten metal from the casting chamber to the mold at a third rate by supplying the gas to the casting chamber during stage 3 at t_2 at P_2 and at t_3 at P_3

to allow the molten metal to rise at the third rate, the third rate being greater than the second rate whereby the mold fills more quickly with molten metal during stage 3 than during stage 2, the third rate operative to produce a third stage actual fill profile; and

(f) controlling the filling of the mold during the fourth time interval t_3 to t_4 of stage 4 by delivering the molten metal from the casting chamber to the mold at a fourth rate by supplying the gas to the casting chamber during stage 4 at t_3 at P_3 and at t_4 at P_4 to allow the molten metal to rise at the fourth ~~rate,~~ rate, the fourth rate operative to produce a fourth stage actual fill profile, the fourth rate being less than the third rate to thereby prevent the actual fill profile at the transition from the end of the third stage actual fill profile to the beginning of the fourth stage actual fill profile from overshooting the desired fill profile and causing the molten metal to bounce and create turbulence in the mold whereby the mold fills more slowly with molten metal during stage 4 than during stage 3 to thereby produce a smooth transition in the filling of the mold cavity indicated graphically by a gradually decreasing slope value during the transition from the end of stage 3 to the beginning of stage 4;

wherein the transducer sends signals representative of the pressures in the casting chamber to the controller and the controller changes the filling of the mold from the first rate to the second rate to the third rate and to the fourth rate.

13. (Previously Presented) A method for filling a mold by a desired fill profile having at least four filling stages, stage 1, stage 2, stage 3 and stage 4, associated with four time intervals, t_0 to t_1, t_1 to t_2, t_2 to t_3, and t_3 to t_4, respectfully, and with four pressure change intervals, P_0 to P_1, P_1 to P_2, P_2 to P_3 and P_3 to P_4, respectively, to make a cast article comprising the steps of:

(a) providing a molten metal to a casting chamber, the casting chamber having a supply conduit for introducing a gas into the casting chamber, and the casting chamber having an evacuation conduit for delivering the molten metal from the casting chamber to the mold;

(b) providing a desired fill profile for delivering the molten metal from the casting chamber to the mold;

(c) detecting the pressure in the casting chamber;

(d) providing a controller and sending a signal representative of the pressure in the casting chamber to the controller; and

(e) changing the desired fill profile based upon the signal representative of the pressure in the casting chamber;

wherein the desired fill profile includes at least controlling the filling of the mold during the first time interval t_0 to t_1 of stage 1 by delivering the molten metal from the casting chamber to the mold at a first rate by supplying the gas to the casting chamber during stage 1 at t_0 at P_0 and at t_1 at P_1 to allow the molten metal to rise at the first rate, stage 1 including an acceleration portion wherein the molten metal is accelerated up to a desired fill rate for stage 1, the first rate operative to produce a first stage actual fill profile, controlling the filling of the mold during the second time interval t_1 to t_2 of stage 2 by delivering the molten metal from the casting chamber to the mold at a second rate by supplying the gas to the casting chamber during stage 2 at t_1 at P_1 and at t_2 at P_2 to allow the molten metal to rise at the second rate, the second rate operative to produce a second stage actual fill profile, the second rate being less than the first rate to thereby prevent the actual fill profile at the transition from the end of the first stage actual fill profile to the beginning of the second stage actual fill profile from overshooting the desired fill profile and causing the molten metal to bounce and create turbulence in the mold whereby the mold fills more slowly with

molten metal during stage 2 than during stage 1 to thereby produce a smooth transition in the filling of the mold cavity indicated graphically by a gradually decreasing slope value during the transition from the end of stage 1 to the beginning of stage 2; controlling the filling of the mold during the third time interval t_2 to t_3 of stage 3 by delivering the molten metal from the casting chamber to the mold at a third rate by supplying the gas to the casting chamber during stage 3 at t_2 at P_2 and at t_3 at P_3 to allow the molten metal to rise at the third rate, the third rate being greater than the second rate whereby the mold fills more quickly with molten metal during stage 3 than during stage 2, the third rate operative to produce a third stage actual fill profile; and controlling the filling of the mold during the fourth time interval t_3 to t_4 of stage 4 by delivering the molten metal from the casting chamber to the mold at a fourth rate by supplying the gas to the casting chamber during stage 4 at t_3 at P_3 and at t_4 at P_4 to allow the molten metal to rise at the fourth rate, the fourth rate operative to produce a fourth stage actual fill profile, the fourth rate being less than the third rate to thereby prevent the actual fill profile at the transition from the end of the third stage actual fill profile to the beginning of the fourth stage actual fill profile from overshooting the desired fill profile and causing the molten metal to bounce and create turbulence in the mold whereby the mold fills more slowly with molten metal during stage 4 than during stage 3 to thereby produce a smooth transition in the filling of the mold cavity indicated graphically by a gradually decreasing slope value during the transition from the end of stage 3 to the beginning of stage 4.

14. (Previously Presented) The method of Claim 13 further comprising the step of providing a transducer to detect the pressures in the casting chamber.

15. (Previously Presented) A method for filling a mold by a desired fill profile having at least two filling stages, stage 1 and stage 2, associated with two time intervals, t_0 to t_1 and t_1 to t_2, respectfully, and with two pressure change intervals, P_0 to P_1, and P_1 to P_2, respectively, to make a cast article comprising the steps of:

(a) providing a molten metal to a casting chamber in fluid communication with the mold, the casting chamber having a supply conduit for introducing a gas into the casting chamber, and the casting chamber having an evacuation conduit for delivering the molten metal from the casting chamber to the mold;

(b) controlling the filling of the mold during the first time interval t_0 to t_1 of stage 1 by delivering the molten metal from the casting chamber to the mold at a first rate by supplying the gas to the casting chamber during stage 1 at t_0 at P_0 and at t_1 at P_1 to allow the molten metal to rise at the first rate, stage 1 including an acceleration portion wherein the molten metal is accelerated up to a desired fill rate for stage 1, the first rate operative to produce a first stage actual fill profile; and

(c) controlling the filling of the mold during the second time interval t_1 to t_2 of stage 2 by delivering the molten metal from the casting chamber to the mold at a second rate by supplying the gas to the casting chamber during stage 2 at t_1 at P_1 and at t_2 at P_2 to allow the molten metal to rise at the second rate, the second rate operative to produce a second stage actual fill profile, the second rate being less than the first rate to thereby prevent the actual fill profile during the transition from the end of the first stage actual fill profile to the beginning of the second stage actual fill profile from overshooting the desired fill profile and causing the molten metal to bounce and create turbulence in the mold whereby the mold fills more slowly with molten metal during stage 2 than during stage 1 to thereby produce a smooth transition in the filling of the mold cavity indicated graphically by a gradually decreasing slope value during the transition from the end of stage 1 to the beginning of stage 2.

16. (Previously Presented) The method of Claim 15 further comprising the step of providing a controller for controlling filling of the mold during the at least two filling stages.

17. (Previously Presented) The method of Claim 15 further comprising the step of providing a transducer to detect the pressures in the casting chamber.

18. (Previously Presented) The method of Claim 15 further comprising the steps of providing a controller for controlling filling of the mold during the at least two filling stages and providing a transducer to detect the pressures in the casting chamber.